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ABSTRACT

This keynote address was presented at Women's Career Day in Computer Sciences at the University of Southern California on October 7, 1978. It gives evidence for the increase in participation of women in science and engineering programs at colleges and universities, as well as the job market. Opportunities for women in the field of computer science are discussed. (BB)

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THE FUTURE OF WOMEN IN SCIENCE AND ENGINEERING

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One of my friends, a practicing attorney, was driving with her young son when they saw a woman driving a large truck in the next lane. Pointing and laughing, her son said, "Oh look, Mommy, a lady truck driver!" "And what's so funny about that?" my friend said, ready to give her clearly chauvinistic offspring a severe lecture on female equality. Unshaken by her disapproving tone, her son replied, "I didn't know ladies could be truck drivers; I thought they all were lawyers."

That story is true, and equally true, "ladies" are today becoming lawyers, doctors, engineers, veterinarians, architects, plumbers and truck drivers in record numbers. Certainly, we are a long way from an androgenous society, with full equality for women, but it is becoming increasingly more difficult for little boys and girls to grow up thinking that women's roles are confined to being wives, mothers and public school teachers.

Women now comprise over half of the total undergraduate enrollment in the United States, and increasing proportions of masters, doctorates and professional degrees are being earned by women. The percent of women receiving medical and

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veterinary degrees has more than doubled since 1970-- to 16% and 18% respectively. The proportion of women receiving degrees in law went from 852 in 1969--5½% of the total--to 6,264 in 1977, almost 20% of the total degrees awarded in law. The number of women doctorates increased by 276% between 1966 and 1976, with an all-time high in 1976 of 23%.

We have truly come a long way, and nowhere is this more evident than in the sciences and engineering. In these traditionally masculine strongholds, women received 17 percent of the doctorates awarded in 1976 compared to less than 13 percent in 1968. Women are moving into all areas of science, and increasing proportions of them are enrolled in and are obtaining degrees in science and engineering. In engineering, historically a field all but closed to women, the percentage of women with engineering degrees was never more than 1 percent of the total population of engineers. Today, the flow of women into engineering is fantastic.

In 1973, 2,417 women were enrolled in freshman engineering. Thirty-seven colleges had 50 or more women enrolled and 7 had over 100 enrolled. By 1975, 6,790 freshmen enrolled in engineering were women, representing over 9 percent of the entering freshman class, and in 1976, 1,376 women received 3.6% of the bachelors degrees awarded in engineering in that year--an infinitesimal amount, but a quantum leap forward from the .41% received 10 years earlier.

In part, women are responding to organized, affirmative

actions of schools to recruit women into the sciences. Career days, such as this one, or conferences sponsored by the National Science Foundation's Women in Science program, are being held on college campuses all over the country to introduce women to the different specialties within the sciences and to provide information about careers for women in occupations that traditionally have not attracted or accepted women. Private industry has provided large amounts of financial support for films, brochures and other materials designed to acquaint women with the enormous opportunities available for them in various scientific professions.

Women across the country are also responding for the first time to the job market. Without question, the most widespread demand today, according to the Engineer/Scientist Demand Index, is for women and minorities. It is interesting to note that as recently as 1974, in a survey of 182 companies and government agencies recruiting engineers on college campuses, one-third of the employers said that they would not consider hiring women because the jobs they were offering were not suitable for women, most of whom "lacked strong career commitment." Today, the opportunities awaiting women in engineering and the sciences in all areas of industry, government and education are almost limitless. Starting salaries offered to women graduates in science and engineering even at the bachelor's level are excellent, and in some cases exceed those offered to men. Women scientists/engineers with a Ph.D. are at a premium.

Equally excellent employment opportunities are available

for women in computer occupations. Compared to traditional disciplines such as physics, chemistry or engineering, computer science is a relatively new field. Various mechanical devices have been used to help people process data throughout history, beginning with the abacus thousands of years ago. But it was not until 1937, when the first automatic computing device was developed by Dr. Howard Aiken at Harvard University, that a "field" of computer science began to develop and a wide range of trained personnel became needed. Systems analysts and programmers in particular are among the most rapidly growing professional and technical occupations in the economy, with the most rapid employment increase expected in hospitals, educational institutions and data processing services. Programmers and system analysts will continue to be needed as an increasing number of hospitals automate food services and computerize patient records. Medical information and communication systems are expected to grow as will computerized systems for medical diagnosis and instruction.

Tremendous growth is also expected in education. Manpower requirements for computer-assisted instructional systems, automated library operations, such as acquisitions and cataloguing, automated administrative services including class scheduling, student record maintenance and enrollment will assure the need for computer specialists in the educational sector.

Service bureaus and computer maintenance firms will also

contribute heavily to the overall growth of computer occupations in industry. Computerized ordering and inventory systems by wholesalers will speed the growth of computer manpower requirements in wholesale and retail trade, and computer manpower requirements in government will increase dramatically over the next decade as new information systems are installed and existing ones expand their capabilities. State and local governments will be developing consolidated systems serving a greater variety of information processing needs and will increase to a great extent their use of terminal networks and other data communications technology in their operation.

Like the field of engineering, the field of computer science is expanding and computer technology is being applied innovatively in a wide range of creative areas such as dance, literature and history. The computer has been used to generate instructions for ballet dancers since 1964. It aids choreographers and dancers to visualize body movements and allows them to "practice" various routines quickly on the computer rather than taking days of actual practice. The storage capacity and speed of the computer is being applied to help the scholar describe and critique literary work, and to trace the development of style and ideas in literature and history.

Clearly, computer occupations will continue to grow, and the increasing sophistication and complexity of computer personnel functions will require workers with greater amounts

of specific computer related training than was formerly true. In the past, women have tended to occupy the lower level jobs in computing, most particularly keypunching and simple programming. Now, and increasingly in the future, systems analysts, who have always been in great demand, will be sought after even more intensely. And women can and will seek the training to occupy these positions.

According to the September, 1978 issue of Computer, a trade magazine, computer science and engineering graduates of the 80's will have completed a 4 or 5 year program in computer science and engineering at a major university. They will have a strong mathematical ability, a knowledge of classical electrical/electronic engineering, a moderate familiarity with computing, heavy "hands on" experiences with digital systems, and a complete working knowledge of software engineering techniques. They will be well-versed in the technical, ethical and economic aspects of the computer industry and may have spent time in an apprenticeship or internship in industry. Equally important, they will be able to communicate with people as well as the computer, serving as translator between the computer and the people with the problems to solve. A tall order, maybe; but women can do it. They have always excelled in communication skills and they can master the technical skills required to work with the computer, even those that are based on a solid knowledge of mathematics.

In the course of our study of women scientists and engineers employed and enrolled in graduate school in colleges and universities, we heard faculty and department heads say time and time again that women did not have the background or interest in mathematics. Many studies have shown that as girls progress through school, their interest in mathematics diminishes, starting as early as sixth grade and continuing through junior and senior high school and college. Various explanations have been offered, including biological theories that women don't have the right hormones or the right brain structure for mathematical problem solving. But most of these theories have been thoroughly discredited and more recent research indicates that fewer women than men pursue math not because of differences in ability but because boys are more aware than are girls that such courses are necessary prerequisites for the kinds of careers they have planned in technological fields.

Unfortunately, lack of exposure to math often creates in many people the fear of the unknown which carries over to the computer, that awesome machine that seems to have such extraordinary powers. Neither math nor the computer are too difficult to understand and you don't have to be a genius. A math textbook is no more incomprehensible than is a book written in English to someone who speaks a totally different language. And that is basically what math is--a different language which can be learned and understood. As far as the computer is concerned, someone recently referred to it as a

"high speed idiot"--a machine which can be learned and understood.

Computer Sciences offers women unique opportunities to be creative--to solve engineering problems, environmental problems, interdisciplinary problems of interest to society. They can also bring other disciplines to bear, using their combined skills in the areas of dance, literature and history. The computer science field also offers flexibility in scheduling not present in all technical fields. Part-time programming work or consulting jobs which offer short term jobs with challenge as well as excellent pay allow women to continue working in the field even if they want to stay home and raise a family.

The purpose of this program is not to talk you all into becoming computer scientists but to give you an idea of the many exciting options available in the field. As I said at the beginning, women are more than ever before beginning to move into areas of science and engineering. But it is only a beginning and we need many, many more of you before we really can achieve equality in the world of science. So please join us and let us answer your questions and help you explore all of the alternatives available to you.